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The growth response stem cuttings of roses (*Rosa sp)* to plant growth regulator Atonik and Rootone-F

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ABSTRACT

This study aimed to find out the effectiveness Atonik and Rootone F to the growth response stem cutting of Rosa sp. The method used was experimental method completely randomized factorial design, with four replications. The first factor was the growth regulator atonik that given to the level of concentration of 0.0 to 3.0 ml/L. The second factor was the growth regulator Rootone F with a concentration of 2.5 mg. Result showed at the first week after planting, stem cuttings of roses had shown the shoot growth response. At the fifth weeks, all aspects of vegetative growth on stem cuttings of roses reached maximum growth. Concentration of 3.0 ml/L Atonik could increase the maximum growth of stem cuttings of roses, until at the fifth weeks could reached an average of 3 shoots, 5.6 cm of long shoot, 5 petioles per bud, 5 leaves per petiole, 3.3 cm of long petiole, 4 cm of long leaves, 7.5 cm of long root, and 26 roots. Treatment of 3.0 ml/L atonik effective in improving vegetative growth on stem cuttings of Rosa sp.

Key words: *Rosa sp*, stem cutting, Atonik, Rootone-F

INTRODUCTION

Rosa sp is a type of wild rose that grows mostly in the northern hemisphere with about 200 species and 20,000 cultivars are widely spread all over the world. Rose is an important genus in very genus of economically on ornamental plant floriculture industry that used as garden plant, cutting flower or plant in the door [26]. National demand for ornamental plant and cutting flower increased at no less than 25% each year, while the development of production increased in 20%. Demand of rose as cutting flower increased in 10% per year [6]. Besides, the cultivated of Rose is dealing with the perfume and medicine industry. Rosa contains 300 constituents, but only about 100 constituents were detected benefits. The main constituens include vitamin C, B, E, K, tannin, geraniol, nerol, citronellol, geranic acid, terpene, pectin, polyphenol, carotenoid, vanillin, stearopten, farnesol, fenyletanol, nonilaldehida, eugenol, feniletilalkohol, alkene, derivative furan, flavonoid, phenolic, and β-carotene [19]; [17]; [9]. Components of essential oil on the rose hips is vitispiran (isomers), α-E-acaridial, dodecanoic acid, hexadecanoic acid, docosane (C22), -ionone, 6-methyl-5-hepten-2-one, 2-heptanone, heptanal, myristic acid and linolic acid [24]. Rose essential oil is obtained by distillation water from the petals, have large application in several industries to fragrance and scaffolding, direct consumption or makes various types of food products [17];[19]. The quality of essential oil of rose associated with genetic characteristics and environmental pressures [23]. As a result of a variety of benefits, Rosa flower has a great demand throughout the year. To supply marketing demand, this plant can be propagated by vegetative propagation stem cutting. This technique is one alternative for obtaining new plant quantity and quality, which has the same character as its parent, and is obtained in a short time.

One of the main problem to generate Rosa is the result of flower is low, especially in winter, many lost flowers the otherside the market is very profitable. To improve all aspects of its growth vegetative can be performed by using plant growth regulator. One management technique to optimize growth and flowering of rose is the utilization of plant growth regulator. This technique is the best way to improve the quantity and quality of rose flower [16]. The use of plant growth regulator such as auxin can improve the quantity and quality of crops. This growth regulator can

be obtained easily and affordable [8]. To accelerate the success of the breeding technique through vegetative propagation, it is necessary the use of plant growth regulator in helping the growth of root. Many types of plant growth regulator which can stimulate the growth of shoots and roots on cutting plant. According to Hartmann *et al*. (1997) plant growth regulator most instrumental in rooting of cuttings is auxin. Commonly known auxin is indole-3-acetic acid (IAA), indolebutyric acid (IBA) and napthaleneacetic acid (NAA). Growth regulator IBA and NAA are more effective when compared to the IAA which is a natural auxin. Substance growth regulator auxin types have the potential to stimulate growth in the vegetative propagation of stem cuttings in various types of plants. Likewise for stimulate the growth of stem cuttings of roses, plant growth regulator has been widely used, such as IBA can stimulate the formation of adventitious root on Canina rose and Dumalis rose [7], can increase the percentage of maximum rooting stem cuttings Damask rose [21], propagating stem cuttings Rosa [1], together with IAA can stimulate a growing percentage of the maximum on stem cuttings of *Rosa bourboniana* [18]. Likewise NAA more effectively stimulate the growth of stem cuttings of roses compared to IAA [20]. The application of product that contains synthetic auxin for Rosa vegetative propagation of stem cutting were not widely reported. The application of Rootone F and Atonik as growth regulator are more economic these are cheaper than IAA and IBA hormone, and easy to find on the market. Rootone-F consists 0.067% I-Naphtalene-acetamide (NAD), 0.333% 2 Methyl-1-Naphtalene acetic acid (MNAA), 0.0135 3-Methyl-I Naphtalene acetamide (MNAD), 0.051% Indole-3-butyric acid (IBA) and 4% Tetranethyl-thiuram disulfide (Thiram). According to Gustini *et al.* (2012) Rootone-F can enhance root growth and seedling *Salacca edulis* Reinw, as well as potentially also increase the percentage growth of cayenne pepper plant stem cutting[10]. According to Sudomo *et al.* (2013) Rootone-F 100 ppm effectively stimulate the growth of shoot and root of the shoot cutting Manglid (Manglietia glauca BI). Similarly Atonik influence on the growth plant of stem cutting. According to Górnik & Grzesik (2005) application Atonik (sodium ortho and para-nitro phenol, sodium nitro guaiakolat 5) can increase both the quality and quantity of crops and vegetative growth in plant. In addition Atonik application can affect the content of essential oils in plants [22]. However, when compared with the plant growth regulator Atonik 1-2 ml/L, Rootone F is smeared evenly on stem cuttingof green rose (*Rosa x odorata*"viridiflora") is more responsive to stimulate vegetative growth [27]. Based on some of the results of this study indicate that the plant growth regulator auxin potense for stimulating rooting and sprouting in vegetative propagation of cuttings from various plants, mainly on plant stem cutting. However, to obtain the expected result is very important to choose a suitable plant growth regulator. It must be effective, ecological, and can reduce the influence of unfavorable environmental condition. This study aims to determine the effectiveness of Atonik and Rootone-F for vegetative growth response of plants stem cuttings of roses (*Rosa sp*).

EXPERIMENTAL SECTION

This study was conducted in plantation society Tanjung Mulia, Medan in September to December 2014. The main material that used in this study is roses obtained from the cultivation of the local community, growing media (topsoil:manure:sand = 1:1:1), Atonik, Rootone-F, Furadan 3G, Dithane M45, etc. The main tool that used is the cutter cutting scissors, shovel, sieve, scales, polybag, measuring tools, stationery, handsprayer, etc. Using method was experimental method with a completely randomized design with factorial pattern, with 4 replications. Each treatment consist of five stem cuttings. The first factor is the Atonik with 4 levels, namely: 0.0 ml/L, 0.5 ml/L, 1.0 ml/L, 2 ml/L, and 3 ml/L Atonik. The second factor is Rootone-F 2.5 mg/L.

The procedure works: materials stem cuttings of roses about 20-25 cm is prepared, growing medium in the ratio 1:1:1 = topsoil:manure:sand, put in a polybag, cutting material that has soaked into the Atonik, and is smeared with Rootone F dealing with the treatment was planted into the growing medium which has been drawn up in a location that is protected from direct sunlight, maintenance performed include watering taste. To prevent the occurrence of nematode attack, at any given polybag Furadan 3G, and to prevent fungus attacks, the cuttings given Dithane M45 0.1%. Observations were made on the percentage of live cuttings, shoot length, number of shoots, number of leaves, leaf length, root length, number of roots. The data were analyzed using analysis of variance (ANOVA) and further tested by Duncan's Multiple Range Test (DMRT) for significant 5%.

RESULTS AND DISCUSSION

Based on field observations, this study to obtain results, in the first week after planting, the growth response in stem cuttings of roses have been seen almost in all treatments except the control. In the second week, the response to the growth of controls began to be seen new. All aspects of the growth of the stem cuttings of roses is responding positively to the initiation of the growth of shoots and leaves up to the petiole, and rooting more increased up to fifth weeks. At fifth weeks, when compared between the treatment Atonik, the concentration of 3 ml/L is more responsive than the other treatments, as well as when compared with the treatment of Rootone-F. These results indicate that the treatment Rootone-F 2.5 mg/L for stem cuttings of roses unresponsive when compared with the treatment of Atonik. The response is very slow growth until 5^{th} weeks.

Table 1. The Growth Response of Stem Cuttings of Roses Cause of Giving Atonik and Rootone-F at 5th Weeks

Treatment	Number of shoots	Length of shoots (cm)	Number of leaves/ petiole	Number of petioles/shoot	Length of petiole (cm)	Length of leaves (cm)	Length of root (cm)	Number of roots
Ao = 0,0 ml/L	1,5 c	0,8 d	4,5 a	2,0 bc	2,1 b	2,5 b	0,3 d	1 e
A1 = 0,5 ml/L	1,75c	4,3 b	5 a	4,5 a	3,6 a	3,0 b	2,7 c	7 d
A2 = 1,0 ml/L	2,75b	1,0 d	4,5 a	3,0 ab	3,3 a	2,8 b	3,5 b	19,3 b
A3 = 2,0 ml/L	3 ab	0,4 d	4,5 a	1,25 c	1,6 b	2,7 b	2,5 c	13 c
A4 = 3,0 ml/L	3 a	5,6 a	5 a	4,5 a	3,3 a	4,0 a	7,5 a	29,3 a
R = 2,5 mg	1,75 c	2,2 c	4 a	3 ab	1,0 c	1,0 c	4,0 b	4 de
BNT 5%	0,63	0,68	1,26	1,52	0,56	0,71	1,99	4,48

Description: Values followed by the same letters in the same column it means no significantly different in LSD 5%.

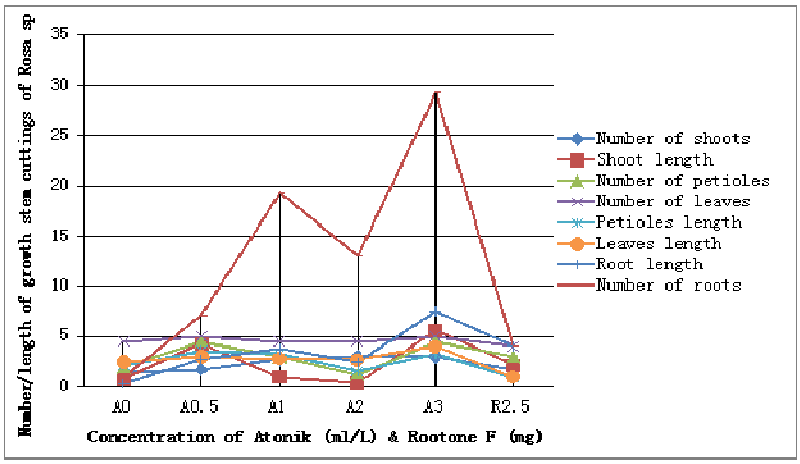

Figure 1. The Growth Response of Stem Cuttings of Roses to Atonik dan Rootone-F at 5th Weeks

Based on the analysis of variation (ANOVA), Atonik plant growth regulator treatment or Rootone F significantly affect all aspects of the growth of stem cuttings of roses as measured in this study, except for the amount of plant leaves rose. Then based DMRT, obtained the results as shown in **Table 1**. Parameter growth in the number of shoots on the stem cuttings of roses at 5th weeks showed maximal response to be able to reach an average of three buds on each treatment Atonik at a concentration of 3 ml/L. Number of shoot is 2 times higher when compared with the untreated (control), and also significantly different to the treatment Rootone-F. But not different to the treatment of 2 ml/L Atonik. Similarly to the length of shoots, treatment of 3 ml/L Atonik significantly when compared to other treatments and Rootone F. leght of shoots that obtained maximum length of 5.6 cm (7-fold compared with the controls 0.8 cm). Likewise, to the number of petiole, this treatment is significantly different from other treatments, except the control and treatment of 2 ml/L Atonik. Similarly to the length of the petiole, giving 3 ml/L Atonik not significantly different to other treatments except control and 2 ml/L Atonik, as well as significantly different to Rootone F (3 times). The response to the growth of leaf length parameter, treatment 3 ml/L Atonik significantly different with all treatments and 4-fold compared to Rootone F. While the length root parameter, this treatment also significantly different to other treatments and 25-fold when compared with control, and 1,875-fold when compared with Rootone F. Response growth in the number of leaf parameters, this treatment also significantly different with all treatments (29.25-fold compared with controls, and 7.31-fold compared with Rootone F). However, the aspect the number of leaves was not significantly different at each treatment. Response growth of stem cuttings of roses can be seen in **Figure 1**. Treatment of 3 ml/L Atonik beside effectively induce the formation and growth as well as development of shoot is also highly effective in stimulating the formation, growth and development of root in stem cuttings of rose. Response growth of every aspect of the parameter in this study can be more clearly seen in **Figure 2** and **Figure 3**.

The Atonik growth regulator can stimulate vegetative growth of the plant [11]; [5] and [4]; [22]; [31]; [15]. Similarly, Rootone-F can increase the percentage growth of root and shoot in the plant stem cuttings [10]; [30]. In this study, in addition to the type of growth regulators, also the concentration of growth regulator is an important factor, which is closely related to its role to increase the growth shoot and root on stem cuttings of roses up to obtain maximum growth and development.

Figure 2. The Stem Cuttings of Roses Age of 5th Weeks after the Plant, with the Treatment of 2.5 mg/L Rootone-F (F), Control (Ao), and 3 ml/L Atonik (A4)

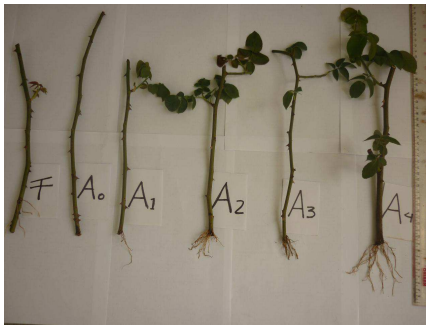

Figure 3. The Growth of Root on Stem Cuttings of Roses Great Age of 5th Weeks after the Plant, the Treatment 2.5 mg Rootone-F (F), Control (Ao), 0.5 ml/L Atonik (A1), 1 ml/L Atonik (A2), 2 ml/L Atonik (A3) and 3 ml/L Atonik (A4)

In this study the growth of stem cuttings of roses give a positive response, increasing up to 5th weeks after being given Atonik and Rootone-F. Almost all aspects of growth (number of shoots, shoot length, number of petioles per shoot, number of leaves per petiole, lenght of petiole, lenght of leaf, lenght of root, and number of roots) on the rose stem cuttings showed a positive response to all treatments Atonik and Rootone-F when compared with no treatment (control). This case shown that auxin contained in Atonik and Rootone-F (contained NAA and IBA) has the potential to stimulate and promote the growth of shoots and roots on the rose's stem cuttings. According to Hartmann *et al*. (1997) growth regulator that is most instrumental in rooting cutting is auxin. Auxin IBA and NAA are more effective when compared to the IAA which is a natural auxin. Ginartha *et al*. (2012) also found that auxin in Rootone-F can increase the percentage growth of root and shoot in the stem cuttings. But in this study, plant growth regulator Atonik more effectively promote the growth of stem cuttings of roses when compared with the treatment of growth regulator Rootone-F. Especially the concentration of 3 ml/L Atonik more effectively stimulating the growth of stem cuttings of roses is when compared to other treatments Atonik and also treatment Rootone-F. This means that in improving growth response stem cuttings of roses is required type and concentration of highly effective (3 ml/L Atonik) to increase the sensitivity of cells from tissue stem rose so the faster growth of the stem cuttings of roses. According to Djanaguiraman *et al*. (2004) Atonik 0.25% very effectively increase the length of the fiber in plant. Atonik is possible to increase the flow of internal auxin or to modulate turgor in the cell wall that are changed by the elasticity of the cell, as a model of the action of auxin. Similarly, the growth of stem cuttings of this roses. Increased growth the aspect of stem cuttings (especially the growth of shoot and root) in the treatment of 3 ml/L Atonik may be effective to improve the flow of internal auxin or to modulate the turgor pressure in the wall of cell that are changed by the elasticity of the cell, as a working model of auxin. The working of the hormone auxin is to initiate cell elongation and also stimulate specific protein in the plasma membrane of plant cell to pump H^+ ions into the wall of cell. H^+ ions activate certain enzyme that break multiple hydrogen with chain crosslinking the cellulose molecules making up the cell wall. Plant cell then extends as result the water entering by osmosis [3]. Rechenmann (2010) also found auxin induces the expansion and loosing of the cell wall. Working of auxin is associated with the activation of which stimulates the ATPase proton pump acidity extracellular space, and activate the cell wall protein (such as expansion and xyloglucan endotransglycosylase/hydrolase) that regulate loosing of the cell wall which to work on the network of the cell wall polysaccharides. The activation of H^+ -ATPase also induces hyperpolarisasi plasma membrane and activates K^+ enter to the right channel, it is important to absorption of water in support the expansion of cell. Auxin also enhances this effect by inducing the expression of genes encoding plasma membrane ATPase, K^+ channels, expansion, and re-establishment of the cell wall enzyme and stimulate of new material export of the cell wall.

According to Górnik *et al*. (2007) Atonik application 0,2% to plant grape cuttings can improve tolerance to temperature stress and drought. This is likely to occur at 3 ml/L Atonik is applied to the stem cuttings of roses. Concentration of 3 ml/L Atonik effective possibility to increase tolerance to growing media/environment that causing the adaptation process more quickly so more responsive implement growth. Atonik growth regulator is containing phenolic compounds [31]. According to Górnik & Grzesik (2005) Atonik perfectly can become the technology needed for environmental protection. Atonik contains natural compounds (sodium ortho and para-nitro phenolate, sodium 5 nitro guaiacolate) which stimulates several physiological processes. These compounds are required in the metabolic process, which is transformed in plants into substances that stimulate the mechanism of strengthening the cell wall, which resulting in increased resistance to the environmental condition are not good. This substance can also increase the activity of auxin and stimulate nitrogen reductase enzyme activity and tyrosine phosphatase. This enzyme play a key role in regulating ion channels and accelerate the assimilation transport from leaf to generative organ and storage organ [31]. Haroun *et al.* (2011) also found application Atonik can improve all aspects of vegetative growth, accelerate inflorescence, and increase pigment, glucose, sucrose, polisakarida and

ammonia, amino, and total nitrogen and protein, and also significantly increase the content of K^+, Na^+, and Ca^+ in the roots and shoots.

Rootone F is one plant growth regulator which consists of a mixture of NAA and IBA, which are both classified as auxin which acts as a stimulator of cell division and produce better root formation [10]. Supriyanto and Prakasa (2011) also found Rootone-F can increase the percentage of rooted cutting and growing percentage of stem cuttings for vegetative propagation of plant. However, in this study the treatment of Atonik more effectively stimulate the growth of stem cuttings of roses compared to Rootone-F. It is probable concentration of 2.5 mg/L Rootone-F is less effective to stimulate the cells sensitivity of tissue stem cuttings is to improve the division and cell elongation for growth. According to Rechenmann (2010) Auxin is a major stimulant affecting the mechanisms of cell wall extension irreversible, but also controlled several other phytohormones. Cell expansion of dependent Auksin following the dose-response curve, which when high concentrations become obstructed. However, the maximum-response varies according to the plant and organ with shoot and root showed difference in sensitivity several order of magnitude.

The low growth response stem cuttings of roses to Rootone-F treatment was possible due to lack of concentration effective to stimulate its growth, may also be related to the ratio of endogenous hormone auxin, which is influenced by the concentration Rootone-F are given. It can inhibit the growth and development of stem cuttings to induce shoot and root. Reduction in the growth of stem cuttings of roses explained by variations in the level of endogenous hormone by the plant growth regulator that gives the change in the speed of growth and development. Su *et al. (*2011) argues that the nature of the cells in specific tissues depends on the ratio between auxin and cytokinin, which maintain cell proliferation or stimulate differentiation of cells to form new organs such as shoots or roots. The balance between cell division and cell differentiation is necessary to control the size and structure of the shoot apical meristem. Campononi & Nick (2005) also found two types of auxin is NAA and 2,4-D show a different effect on cell division and cell elongation. These two types of auxin controls cell division and cell elongation through different receptors, on different lines, so its affinitas different for the different ligand. It is associated with a different dose response. In this study, the concentration of Atonik be a limiting factor for growth response stem cuttings of roses.The higher the concentration the higher the positive response Atonik growth and development of stem cuttings of this roses. There is a possibility of transition from initiation shoot and root to conditions of growth and development process may actually be controlled by changes in the level of endogenous growth hormone such as auxin and cytokinin or balance between these hormones.

CONCLUSION

Atonik and Rootone F growth regulator significantly affect the vegetative growth of stem cuttings *Rosa sp.* except for number of leaves. All aspects of vegetative growth on stem cuttings of roses is responding positively to treatment Atonik at concentrations 3.0 ml/L until 5^{th} weeks. Concentration of 3.0 ml/L Atonik can stimulate vegetative growth the highest in the cuttings of rose to obtain an average of 3 shoots, 5.6 cm length of shoots, 5 sprigs of leaves per bud, 5 leaves per petiole, 3.3 cm length of leaves sprig, 4 cm length of leaves, 7.5 cm root length, and 26 the number of roots. Treatment of 3.0 ml/L Atonik effectively improve the vegetative growth of stem cuttings on *Rosa sp.*

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